

APPENDIX D TO PART 835—SURFACE
CONTAMINATION VALUES

The data presented in appendix D are to be used in identifying the need for posting of

contamination and high contamination areas in accordance with §835.603(e) and (f) and identifying the need for surface contamination monitoring and control in accordance with §§835.1101 and 835.1102.

SURFACE CONTAMINATION VALUES ¹ IN DPM/100 CM²

Radionuclide	Removable ^{2,4}	Total (Fixed + Removable) ^{2,3}
U-nat, U-235, U-238, and associated decay products	7 1,000	7 5,000
Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129	20	500
Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	200	1,000
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above ⁵	1,000	5,000
Tritium and STCs ⁶	10,000	See Footnote 6

¹The values in this appendix, with the exception noted in footnote 6 below, apply to radioactive contamination deposited on, but not incorporated into the interior or matrix of, the contaminated item. Where surface contamination by both alpha- and beta-gamma-emitting nuclides exists, the limits established for alpha- and beta-gamma-emitting nuclides apply independently.

²As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

³The levels may be averaged over one square meter provided the maximum surface activity in any area of 100 cm² is less than three times the value specified. For purposes of averaging, any square meter of surface shall be considered to be above the surface contamination value if: (1) From measurements of a representative number of sections it is determined that the average contamination level exceeds the applicable value; or (2) it is determined that the sum of the activity of all isolated spots or particles in any 100 cm² area exceeds three times the applicable value.

⁴The amount of removable radioactive material per 100 cm² of surface area should be determined by swiping the area with dry filter or soft absorbent paper, applying moderate pressure, and then assessing the amount of radioactive material on the swipe with an appropriate instrument of known efficiency. (Note—The use of dry material may not be appropriate for tritium.) When removable contamination on objects of surface area less than 100 cm² is determined, the activity per unit area shall be based on the actual area and the entire surface shall be wiped. It is not necessary to use swiping techniques to measure removable contamination levels if direct scan surveys indicate that the total residual surface contamination levels are within the limits for removable contamination.

⁵This category of radionuclides includes mixed fission products, including the Sr-90 which is present in them. It does not apply to Sr-90 which has been separated from the other fission products or mixtures where the Sr-90 has been enriched.

⁶Tritium contamination may diffuse into the volume or matrix of materials. Evaluation of surface contamination shall consider the extent to which such contamination may migrate to the surface in order to ensure the surface contamination value provided in this appendix is not exceeded. Once this contamination migrates to the surface, it may be removable, not fixed; therefore, a "Total" value does not apply. In certain cases, a "Total" value of 10,000 dpm/100 cm² may be applicable either to metals, of the types which form insoluble special tritium compounds that have been exposed to tritium; or to bulk materials to which particles of insoluble special tritium compound are fixed to a surface.

⁷These limits only apply to the alpha emitters within the respective decay series.

[58 FR 65485, Dec. 14, 1993, as amended at 63 FR 59688, Nov. 4, 1998; 72 FR 31940, June 8, 2007; 74 FR 18116, Apr. 21, 2009]

APPENDIX E TO PART 835—VALUES FOR
ESTABLISHING SEALED RADIOACTIVE
SOURCE ACCOUNTABILITY AND RADIO-
ACTIVE MATERIAL POSTING AND LA-
BELING REQUIREMENTS

The data presented in appendix E are to be used for identifying accountable sealed radioactive sources and radioactive material areas as those terms are defined at §835.2(a), establishing the need for radioactive material area posting in accordance with §835.603(g), and establishing the need for radioactive material labeling in accordance with §835.605.

Nuclide	Activity (μCi)
H-3	1.5E+08
Be-7	3.1E+03
Be-10	1.4E+05
C-14	4.6E+06
Na-22	1.9E+01
Al-26	1.5E+01
Si-32	4.9E+04

Nuclide	Activity (μCi)
S-35	2.4E+06
Cl-36	5.2E+05
K-40	2.7E+02
Ca-41	9.3E+06
Ca-45	1.1E+06
Sc-46	6.2E+01
Ti-44	1.5E+02
V-49	1.0E+08
Mn-53	7.5E+07
Mn-54	6.5E+01
Fe-55	2.9E+06
Fe-59	1.9E+02
Fe-60	8.1E+03
Co-56	3.9E+01
Co-57	2.3E+02
Co-58	1.3E+02
Co-60	1.7E+01
Ni-59	3.2E+06
Ni-63	1.3E+06
Zn-65	1.1E+02
Ge-68	5.6E+02
As-73	5.3E+02
Se-75	6.3E+01
Se-79	8.7E+05
Rb-83	9.1E+01
Rb-84	2.0E+02

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Nuclide	Activity (μCi)	Nuclide	Activity (μCi)
Sr-85	1.2E+02	Tb-158	9.0E+04
Sr-89	4.8E+05	Tb-160	1.2E+02
Sr-90	3.5E+04	Dy-159	1.0E+07
Y-88	3.3E+01	Ho-166m	2.1E+01
Y-91	5.0E+04	Tm-170	8.4E+03
Zr-88	1.1E+02	Tm-171	2.8E+04
Zr-93	9.3E+04	Yb-169	5.5E+02
Zr-95	1.9E+02	Lu-173	1.8E+06
Nb-91	6.9E+01	Lu-174	9.3E+05
Nb-91m	3.6E+02	Lu-174m	1.0E+06
Nb-92	1.8E+01	Lu-177m	5.8E+01
Nb-93m	4.4E+02	Hf-172	7.3E+04
Nb-94	2.3E+01	Hf-175	3.0E+06
Nb-95	3.4E+02	Hf-178m	8.7E+03
Mo-93	7.7E+01	Hf-181	3.4E+02
Tc-95m	1.3E+02	Hf-182	7.5E+03
Tc-97	8.1E+01	Ta-179	9.3E+06
Tc-97m	3.5E+02	Ta-182	7.3E+01
Tc-98	2.5E+01	W-181	1.0E+03
Tc-99	8.4E+05	W-185	3.9E+06
Ru-103	4.4E+02	W-188	6.3E+04
Ru-106	2.5E+02	Re-183	5.3E+02
Rh-101	8.7E+05	Re-184	2.6E+02
Rh-102	3.0E+05	Re-184m	1.5E+02
Rh-102m	6.4E+05	Re-186m	3.4E+05
Pd-107	9.3E+06	Os-185	1.3E+02
Ag-105	3.3E+06	Os-194	6.4E+04
Ag-108m	1.8E+01	Ir-192	1.3E+02
Ag-110m	2.2E+01	Ir-192m	1.4E+05
Cd-109	1.6E+02	Ir-194m	2.7E+01
Cd-113m	2.0E+04	Pt-193	8.7E+07
Cd-115m	1.0E+04	Au-195	4.8E+02
In-114m	7.7E+02	Hg-194	5.2E+04
Sn-113	3.1E+02	Hg-203	4.9E+02
Sn-119m	3.3E+02	Tl-204	2.2E+04
Sn-121m	8.1E+05	Pb-202	1.9E+05
Sn-123	1.3E+04	Pb-205	9.0E+01
Sn-126	1.8E+02	Pb-210	9.2E+01
Sb-124	9.1E+01	Bi-207	1.7E+01
Sb-125	6.7E+01	Bi-208	1.5E+01
Te-121m	1.8E+02	Bi-210m	1.2E+03
Te-123m	2.8E+02	Po-209	6.3E+03
Te-125m	4.4E+02	Po-210	1.2E+03
Te-127m	8.0E+02	Ra-226	2.2E+02
Te-129m	2.3E+03	Ra-228	1.5E+03
I-125	3.5E+02	Ac-227	4.2E+00
I-129	1.8E+02	Th-228	8.4E+01
Cs-134	2.6E+01	Th-229	3.1E+01
Cs-135	1.3E+06	Th-230	5.4E+00
Cs-137	6.0E+01	Th-232	9.3E+01
Ba-133	5.1E+01	Pa-231	3.0E+01
La-137	2.7E+05	U-232	1.0E+02
Ce-139	2.4E+02	U-233	3.9E+02
Ce-141	2.4E+03	U-234	2.9E+02
Ce-144	1.4E+03	U-235	6.7E+01
Pm-143	1.3E+02	U-236	3.1E+02
Pm-144	2.9E+01	U-238	3.5E+02
Pm-145	2.6E+02	Np-235	1.1E+02
Pm-146	4.4E+01	Np-236	2.1E+01
Pm-147	7.7E+05	Np-237	4.9E+01
Pm-148m	1.0E+02	Pu-236	2.0E+02
Sm-145	2.4E+06	Pu-237	3.3E+02
Sm-146	4.0E+02	Pu-238	9.0E+01
Sm-151	2.5E+05	Pu-239	8.4E+01
Eu-148	1.1E+06	Pu-240	8.4E+01
Eu-149	1.1E+07	Pu-241	4.6E+03
Eu-152	3.1E+01	Pu-242	8.7E+01
Eu-154	3.1E+01	Pu-244	9.0E+01
Eu-155	3.6E+02	Am-241	7.2E+01
Gd-146	5.1E+05	Am-242m	1.1E+02
Gd-148	9.0E+01	Am-243	7.3E+01
Gd-151	2.9E+06	Cm-241	1.0E+05
Gd-153	2.1E+02	Cm-242	6.2E+02
Tb-157	2.5E+03	Cm-243	4.8E+01

Nuclide	Activity (μCi)
Cm-244	1.5E+02
Cm-245	5.0E+01
Cm-246	1.0E+02
Cm-247	8.5E+01
Cm-248	2.8E+01
Cm-250	5.4E+00
Bk-247	6.0E+01
Bk-249	2.7E+04
Cf-248	4.4E+02
Cf-249	5.5E+01
Cf-250	1.2E+02
Cf-251	5.3E+01
Cf-252	5.2E+00
Cf-254	1.2E+02
Es-254	6.3E+01
Es-255	8.8E+03
Fm-257	5.1E+02
Md-258	6.1E+02

Any alpha emitting radionuclide not listed in appendix E and mixtures of alpha emitters of unknown composition have a value of 10 μCi.

With the exception that any type of STC has a value of 10 Ci, any radionuclide other than alpha emitting radionuclides not listed in appendix E and mixtures of beta emitters of unknown composition have a value of 100 μCi.

NOTE: Where there is involved a mixture of radionuclides in known amounts, derive the value for the mixture as follows: determine, for each radionuclide in the mixture, the ratio between the quantity present in the mixture and the value otherwise established for the specific radionuclide when not in the mixture. If the sum of such ratios for all radionuclides in the mixture exceeds unity (1), then the accountability criterion has been exceeded.

[72 FR 31940, June 8, 2007]

PART 840—EXTRAORDINARY NUCLEAR OCCURRENCES

Sec.

840.1 Scope and purpose.

840.2 Procedures.

840.3 Determination of extraordinary nuclear occurrence.

840.4 Criterion I—Substantial discharge of radioactive material or substantial radiation levels offsite.

840.5 Criterion II—Substantial damages to persons offsite or property offsite.

AUTHORITY: Sec. 161 of the Atomic Energy Act of 1954, Pub. L. 83-703, 68 Stat. 919 (42 U.S.C. 2201); sec. 170 of the Atomic Energy Act of 1954, Pub. L. 85-256, 71 Stat. 576, as amended by Pub. L. 89-645, 80 Stat. 891 (42 U.S.C. 2210); Department of Energy Organization Act, Pub. L. 95-91, 91 Stat. 565-613 (42 U.S.C. 7101-7352).

SOURCE: 49 FR 21473, May 21, 1984, unless otherwise noted.

§ 840.1 Scope and purpose.

(a) *Scope.* This subpart applies to those DOE contractor activities to which the nuclear hazards indemnity provisions in 41 CFR 9-50.704-6 apply, and to other persons indemnified with respect to such activities.

(b) *Purpose.* One purpose of this subpart is to set forth the criteria which the DOE proposes to follow in order to determine whether there has been an “extraordinary nuclear occurrence.” The other purpose is to establish the conditions of the waivers of defenses proposed for incorporation in indemnity agreements.

(1) The system is to come into effect only where the discharge or dispersal constitutes a substantial amount of source, special nuclear or byproduct material, or has caused substantial radiation levels offsite. The various limits in present DOE regulations are not appropriate for direct application in the determination of an “extraordinary nuclear occurrence,” for they were arrived at with other purposes in mind, and those limits have been set at a level which is conservatively arrived at by incorporating a significant safety factor. Thus, a discharge or dispersal which exceeds the limits in DOE regulations, or in DOE orders, although possible cause for concern, is not one which would be expected to cause substantial injury or damage unless it exceeds by some significant multiple the appropriate regulatory limit. Accordingly, in arriving at the values in the criteria to be deemed “substantial” it is more appropriate to adopt values separate from DOE health and safety orders, and, of course the selection of these values will not in any way affect such orders. A substantial discharge, for purposes of the criteria, represents a perturbation of the environment which is clearly above that which could be anticipated from the conduct of normal activities. The criteria are intended solely for the purposes of administration of DOE statutory responsibilities under Pub. L. 89-645, and are not intended to indicate a level of discharge or dispersal at which damage is likely to occur, or even a level at which some type of protective action is